We claim:

1. A gas diffusion structure for polymer electrolyte fuel cells comprising a hydrophobic, sheet-like carbon substrate and having two main opposing surfaces and a contact layer on one of these surfaces, said contact layer comprising an intimate mixture of at least one hydrophobic polymer selected from the group consisting of polyethylene, polypropylene and polytetrafluoroethylene and finely divided carbon particles, wherein the weight percentage of the carbon particles relative to the total weight of the contact layer amounts to 40 to 90 wt.%, wherein said carbon substrate is made hydrophobic by at least one hydrophobic polymer and the hydrophobic polymer is restricted to two layers extending from said two main opposing surfaces of said carbon substrate into said carbon substrate down to a depth of from 5 to 40 μm, said carbon substrate having a measureable pore volume, and the hydrophobic polymer filling from 20 to 60 % of the pore volume within said two layers.

2. The gas diffusion structure according to Claim 1, wherein said two layers contain at least one hydrophobic polymer selected from the group consisting of polyethylene, polypropylene and polytetrafluoroethylene.

3. The gas diffusion structure according to Claim 1 , wherein said carbon substrate has a thickness of from 100 to 400 μm.

4. The gas diffusion structure according to Claim 2, wherein said carbon substrate has a thickness of from 100 to 400 μm.

5. The gas diffusion structure according to Claim 1, wherein said contact layer has a thickness of 5 to 100 μm.

6. The gas diffusion structure according to Claim 2, wherein said contact layer has a thickness of 5 to 100 μm.

7. A gas diffusion electrode for fuel cells comprising a gas diffusion structure and an electrode layer, wherein said gas diffusion structure is the gas diffusion structure according to Claim 1 and the electrode layer is applied to the contact layer of the gas diffusion structure.

8. A membrane electrode assembly for fuel cells comprising a polymer electrolyte membrane and gas diffusion electrodes applied to both faces thereof, wherein the membrane electrode assembly contains at least one gas diffusion electrode according to Claim 7.

9. A polymer electrolyte fuel cell, comprising a membrane electrode assembly according to Claim 8.

10. A process for producing a gas diffusion structure according to Claim 1, comprising preparing the two hydrophobic layers by coating each opposing surface of the carbon support with a paste of a powdered, hydrophobic polymer and a liquid phase and then drying the resulting three-layer structure, calcining said three-layer structure to sinter the hydrophobic polymer and thereafter applying the contact layer to one of the two hydrophobic layers by using an ink which contains a hydrophobic polymer and fine carbon particles and then drying the thus treated carbon substrate, followed by calcining.

11. A process for producing a gas diffusion structure according to Claim 1, comprising preparing the two hydrophobic layers by laying a thin film of a hydrophobic polymer on each of the two opposing surfaces of the carbon support, bonding said layer to the

carbon support by applying pressure and heat and thereafter applying the contact layer to one of the two hydrophobic layers by using an ink which contains a hydrophobic polymer and fine carbon particles, drying the thus treated carbon substrate and then calcining.

12. A process for producing a gas diffusion structure according to Claim 1, comprising preparing the two hydrophobic layers by impregnating the carbon support with a dispersion containing a hydrophobic polymer, and then drying with free access by air to the two opposing surfaces, and then calcining to sinter the polymer and thereafter applying the contact layer to one of the two hydrophobic layers by using an ink which contains a hydrophobic polymer and fine carbon particles, and then drying said carbon substrate and calcining.